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The chemical elements represented in the spectrum of the aurora have not been identified with certainty. A few of the fainter bright lines seem to have their origin in electric discharges thru rarefied nitrogen. It has been suggested that the strong green line has its origin in krypton, one of the rarer elements in the atmosphere. However, krypton is a heavy gas and its existence at the extreme altitudes of auroral displays could scarcely be expected. Again, that one krypton line should be represented so intensively and other krypton lines not at all are circumstances unfavorable to the krypton hypothesis.

Altho auroral displays are seldom observable in California, it should be said that a feeble auroral light seems to cover our entire sky at all times. In 1894 I found that the green line of the auroral spectrum could be observed at Mount Hamilton on any night in any part of the sky. This observation was later confirmed by Fath and others at Mount Hamilton, and by Slipher at the Lowell Observatory. If electrically charged particles in great numbers travel from the Sun to the Earth at times of brilliant displays it must be considered probable that such particles in reduced numbers are travelling from the Sun to the Earth at all times. However, this is mere hypothesis for the present, and not established fact.

W. W. CAMPBELL.

ON CHANGES OBSERVED IN THE NUCLEUS OF THE SPIRAL NEBULA N.G.C. 4254 (MESSIER 99)

Changes in the form and structure of the nucleus of the spiral nebula M 99 (N.G.C. 4254, R.A. $12^h 13^m.7$; Decl. $+14°59'$) were recently detected on the series of photographs of long and short exposures taken with the 40-inch Lowell reflector. As in the case of the earlier observations of the "Crab" nebula (M 1) the possible small changes noted in past years in pairs of plates of different epochs were looked upon as doubtful. In the preceding number of these PUBLICATIONS an account has been given of some of the changes discovered in M 1. The photographs of M 99 taken the present year led to a careful re-examination and intercomparison of all the available plates, and it was found that the nucleus of this nebula varies both in form and in structure. The changes in question are small. There may be a slight variability in the light of the nucleus but I consider the observations uncertain on that point.

Minute variations may occur in other parts of this spiral but it is doubtful if it will be possible to establish from the present material whether or not the suspected changes are real. The observations are difficult as the photographs must be accurately matched both as to intensity and definition. For a given region exposures should be of the proper length to show the detail to the best advantage. In photographs of M 99 too long an exposure would make it very difficult or impossible to detect small changes in the nucleus. Short exposures showing but little more than the nucleus and brighter condensations are valuable.

Observations of many other nebulae in addition to M 1 and M 99 (including a number of spirals), in an effort to detect possible changes, have so far been fruitless but the observing program followed in the past will be continued.

Lowell Observatory, C. O. LAMPLAND.
Flagstaff, Arizona, May 18, 1921.

NOTE ON COMET *b* 1921 (PONS-WINNECKE)

This periodic comet was picked up on its present return by Barnard at the Yerkes Observatory the evening of April 10th. It moves about the Sun with a period of approximately six years. At present (May 4th) it is in the constellation *Hercules* and will be in a favorable position for observation for two or three months.

By estimating the amount of perturbations for the orbit of this comet during its last tour in the neighborhood of *Jupiter*, Crommelin gave an approximate set of elements of the present orbit. According to this estimate the comet would come to perihelion near June 15th this year. The time interval between this date and the last perihelion passage is very closely 5.8 years. Assuming this period of 5.8 years we passed an orbit thru the first three observations available, viz.: April 12th, 17th and 19th. The orbit with a brief ephemeris extending to May 5th was telegraphed to Harvard College Observatory for distribution. This orbit, however, is somewhat in error due to the fact that the right ascension of the middle date (April 17th) was in error by about 22''.

We have just completed a second orbit based on observations of April 12th, 19th and 29th. This orbit also has the assumed period of 5.8 years. The elements together with an ephemeris extending to May 19th have been telegraphed to Harvard College Observatory for distribution.